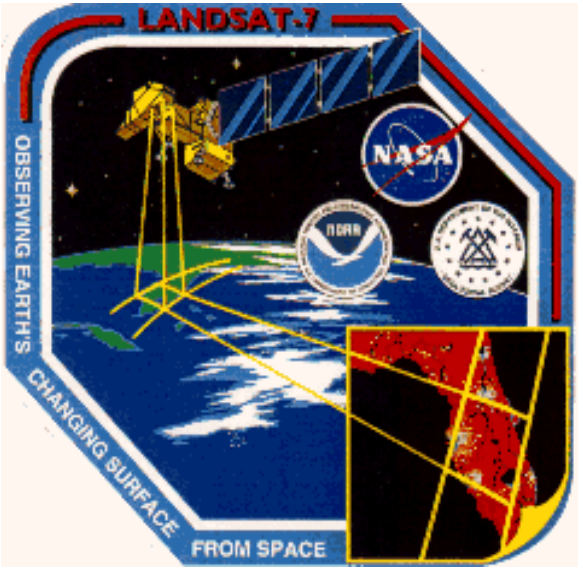
Level 1 Product Generation System (LPGS)



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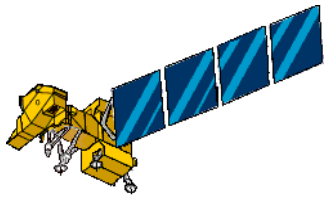
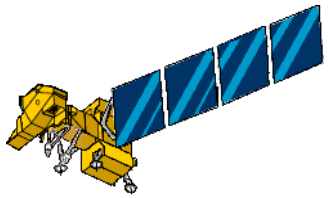
LPGS Documentation Server: **http://lpgs-server.gsfc.nasa.gov**

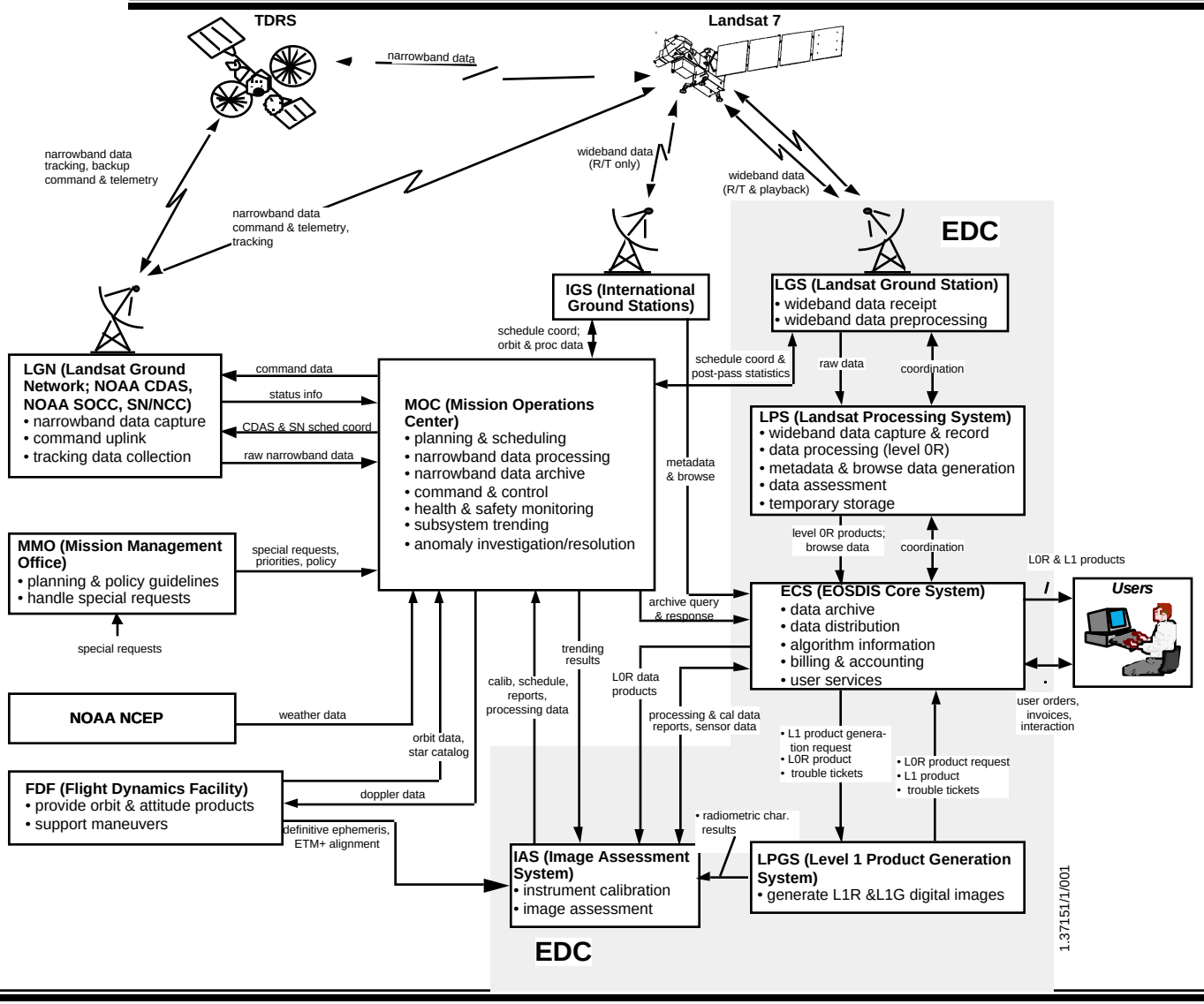


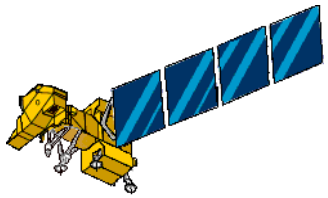
Agenda

- **System Overview**
- **Functionality (High Level Requirements)**
- **User-Selectable Parameters**
- **Level 1 Products**
- **Schedule**



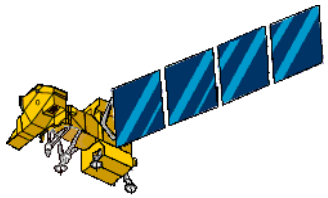
Landsat-7 Ground System



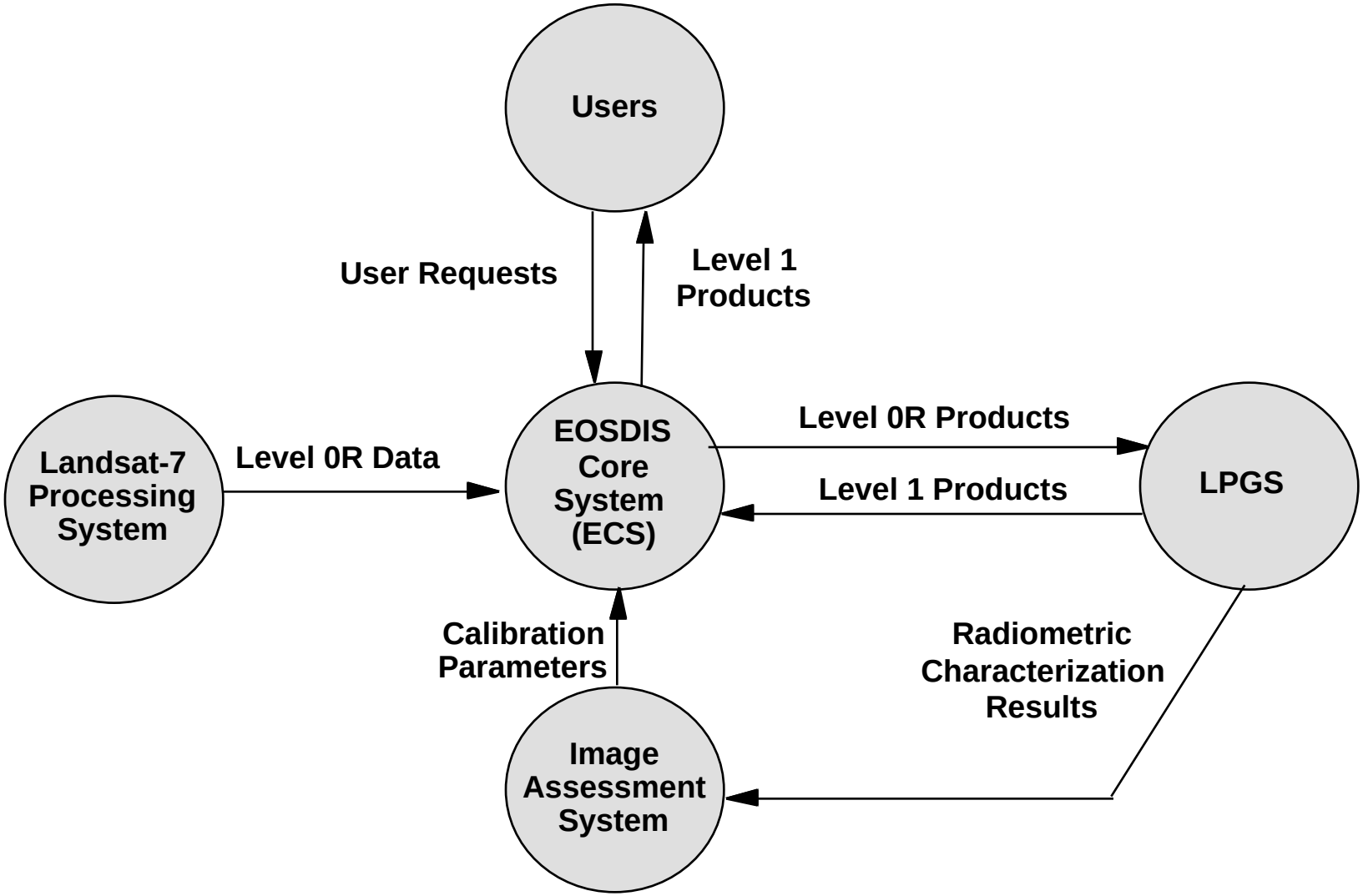


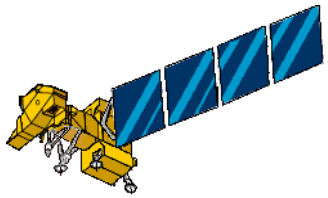
LPGS System Overview

- **LPGS is to provide the Landsat-7 user community with Level 1 digital products:**
  - **Level 1R (L1R) - radiometrically corrected, but not geometrically resampled**
  - **Level 1G (L1G) - radiometrically corrected and resampled for geometric correction and geographic registration; DOES NOT INCLUDE precision or terrain correction**
- **Users order and receive Level 1 products via the Earth Observing System Data and Information System (EOSDIS) Core System (ECS)**



LPGS System Concept

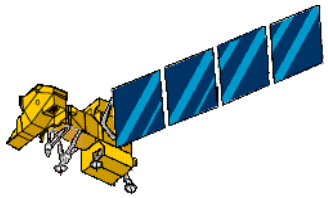




LPGS Functionality
High Level Requirements

- **Process a volume of data equivalent to 25 standard Level 0R world-wide reference system (WRS) scenes to Level 1 digital images per day**
  - **Additional 10% reprocessing (28 total)**
  - **Change request received to increase throughput from 25 to 100 WRS scenes per day**

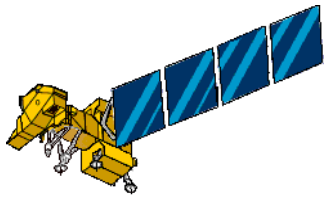
- **Apply compensation for image artifacts**
  - **Banding, striping, coherent noise, memory effect, scan correlated shift, inoperable detectors, saturated detectors, and dropped scan lines**



High Level Requirements (cont'd)

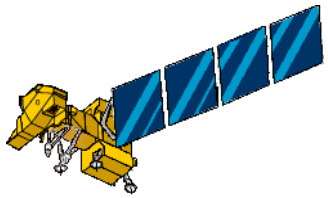
- **Support user-selectable processing options (details later):**
  - **Product selection, map projection, orientation, grid cell size, output product format, band(s) selection, resampling filter, calibration processing**

- **Generate Level 1 digital images corresponding to either**
  - **Heritage WRS scene**
  - **Partial ETM+ subinterval**
    - **Covering any contiguous portion of a subinterval between .5 to 3 WRS scenes**



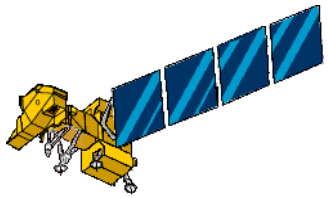
High Level Requirements (cont'd)

- **Provide quality assessment and visual display of Level 1 products**
- **Provide off-line analysis of image processing problems**
- **Interface with ECS to:**
  - **Receive Level 1 product requests and L0R products**
  - **Deliver Level 1 products**
- **Interface with the Image Assessment System (IAS) to transfer radiometric characterization results**



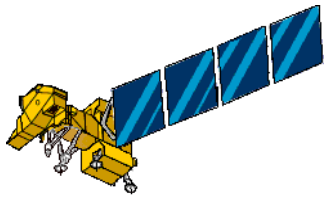
User-Selectable Parameters

- **Product selection**
  - **L1R**
  - **L1G**
- **Coordinate reference system for map projection**
  (and projection-specific parameters)
  - **Space Oblique Mercator**
  - **Universal Transverse Mercator**
  - **Lambert Conformal Conic**
  - **Transverse Mercator**
  - **Oblique Mercator**
  - **Polyconic**
  - **Polar Stereographic**



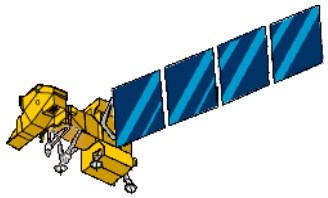
User-Selectable Parameters (cont'd)

- **Orientation**
  - **Nominal path**
  - **North-up**
- **Grid cell size**
  - **Variable from 15 to 60 meters at .001 meter increment**
- **Output product format**
  - **HDF-EOS unencapsulated (L1R or L1G)**
  - **FAST (L1G only)**
  - **GeoTIFF (L1G only)**



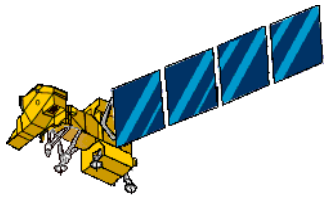
User-Selectable Parameters (cont'd)

- **Selected band(s)**
  - **All 8 or a subset**
- **Resampling filter**
  - **Nearest neighbor**
  - **Cubic convolution**
  - **Modulation transfer function**
- **Calibration processing**
  - **Calibration parameter file**
  - **Internal calibrator**



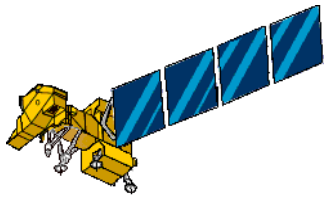
Level 1 Product Formats

- **Output products fully described in the *Earth Science Data and Information System (ESDIS) Level 1 Product Generation System (LPGS) Output Files Data Format Control Book (DFCB)*, August 1997 (accessible via LPGS documentation server)**
- **Level 1 output product formats**
  - **L1R**
    - **HDF-EOS unencapsulated**
  - **L1G**
    - **HDF-EOS unencapsulated**
    - **FAST**
    - **GeoTIFF**



Level 1 Product Formats (cont'd)

- ***L1R - HDF-EOS Unencapsulated***
  - **Image data (each file contains one band of image pixels in 16-bit unsigned integers)**
  - **Consensus MSCD (subsetted according to product ordered)**
  - **Consensus PCD**
  - **Calibration parameter file**
  - **Internal calibrator data**
    - **Format 1 for products that include bands 1 through 6 low**
    - **Format 2 for products that include bands 6 high through 8**
    - **Subsetted according to the product ordered**
  - **Geolocation index**
  - **Scan line offsets (subsetted according to the product ordered)**
    - **Format 1 for products that include bands 1 through 6 low**
    - **Format 2 for products that include bands 6 high through 8**
  - **LPS metadata (Format 1 and Format 2)**
  - **LPGS metadata**



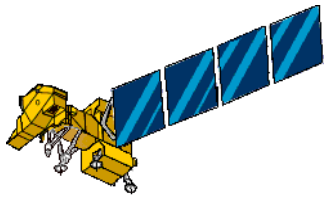
Level 1 Product Formats (cont'd)

L1G - HDF-EOS Unencapsulated

- **Image data (each file contains one band of image pixels in 8-bit unsigned integers)**
- **LPGS metadata**

L1G - FAST

- **Header file**
  - **Administrative record contains information identifying product, image, and data needed to ingest image data**
  - **Radiometric record contains coefficients needed to convert image digital values into at-satellite spectral radiance**
  - **Geometric record contains image geodetic location information needed to align imagery to other data sources**
- **Image data (each file contains one band of image pixels in 8-bit unsigned integers)**



Level 1 Product Formats (cont'd)

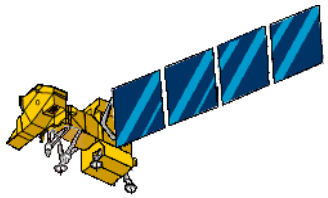
L1G - GeoTIFF

- File (all requested bands of image data in 8-bit unsigned integers + metadata)
- GeoTIFF products cannot be ordered in Space Oblique Mercator or Oblique Mercator Type A projections

LPGS Metadata

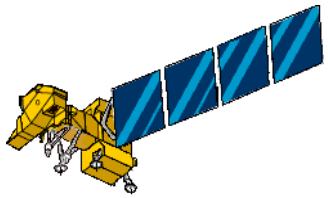
- Included with HDF-EOS unencapsulated L1R and L1G products
- Contains
  - HDF directory
  - Filenames
  - Band combination
  - Product path and row
  - Product corners
  - Gains
  - Corrections applied
  - Minimum and maximum detected radiance
  - Datum*
  - Ellipsoid *
  - Grid cell size *
  - Orientation *
  - Resampling method*
  - Map projection*
  - Projection parameters*

*L1G product only



Schedule

- **System Requirements Review/System Design Review** — **12/96**
- **Preliminary Design Walkthrough** — **4/97**
- **Critical Design Review** — **8/97**
- **Release 1** — **4/98**
- **Release 2** — **7/98**
- **Shipment to EDC** — **8/98**
- **LPGS Operational** — **Installation + 90 to 120 days**



Acronyms

DFCB	**Data Format Control Book**
ECS	**EOSDIS Core System**
EDC	**EROS Data Center**
EOS	**Earth Observing System**
EOSDIS	**EOS Data and Information System**
EROS	**Earth Resources Observation System**
GSFC	**Goddard Space Flight Center**
HDF	**Hierarchichal Data Format**
IAS	**Image Assessment System**
L0R	**Level 0R**
L1G	**Level 1G (geometric)**
L1R	**Level 1R (radiometric)**
LPGS	**Level 1 Product Generation System**
LPS	**Landsat-7 Processing System**
MSCD	**Mirror Scan Correction Data**
NASA	**National Aeronautics and Space Administration**
PCD	**Payload Correction Data**
WRS	**World-wide Reference System**